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Generation Inputs Workshop

May 13, 2014

Agenda for 13 May 2014

- Decision on Separate Public Process for Balancing Service Rate Case Inputs
- BPA Staff Straw Proposal Discussion
- Balancing Reserve Forecast Performance Update
- Results of beta test and other Pre-schedule Imbalance Capacity Acquisitions
- Dispatchable Energy Resource Balancing Service (DERBS) Update
- Solar Photovoltaic Study Update and Solar Sub-team Proposal
- Customer Presentations



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**Decision on Separate Public
Process for Balancing Service
Rate Case Inputs**

Introduction

At the ACS Settlements Workshop on April 1, BPA discussed the concept of removing one or more elements from the rate process and moving them into a separate public process. The customers were asked to provide written comments:

Summary of Comments received:

Majority of Responses stated:

- For BP-16 – keep all elements in the Rate Case Process.

Other responses included:

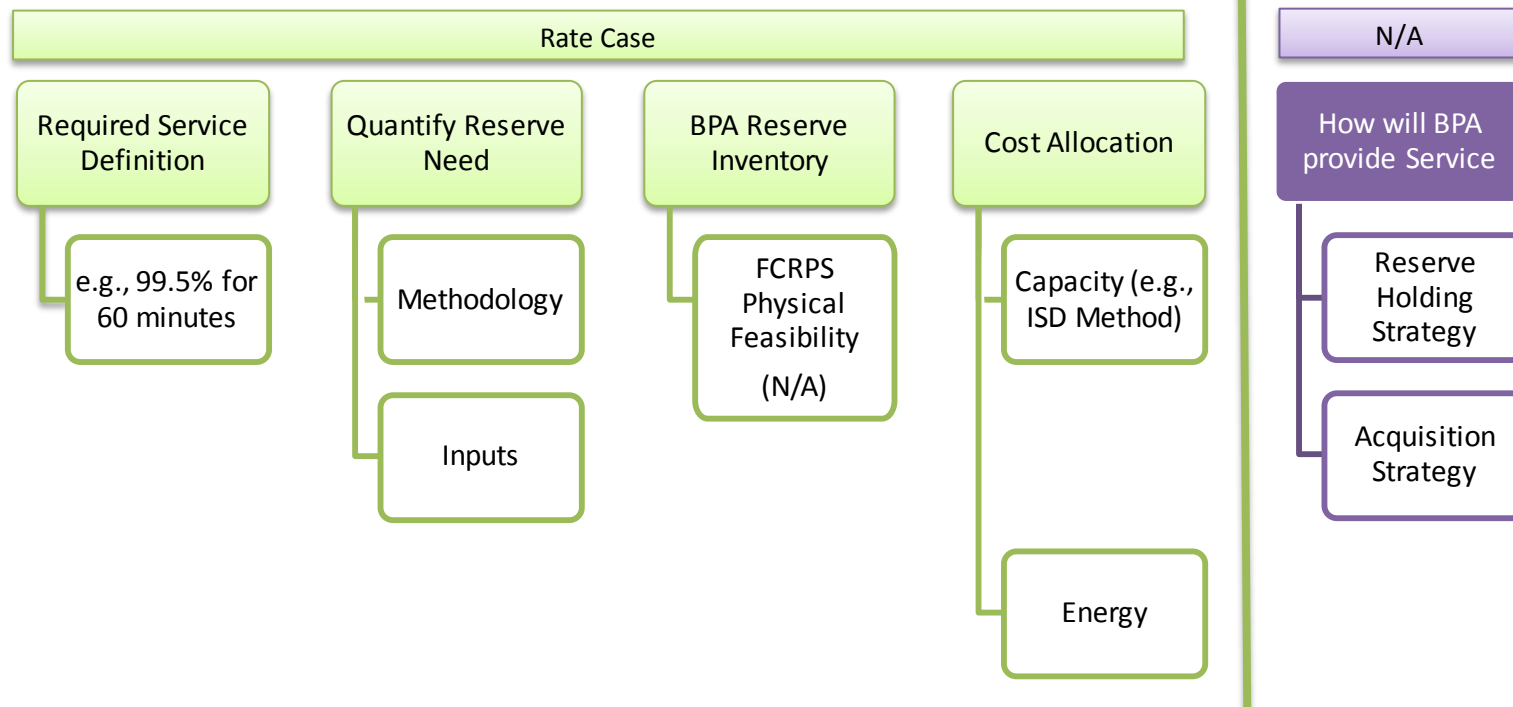
- BPA should adopt a pro forma OATT Schedule 9
- For BP-16 – all three elements should be addressed in a separate public process.



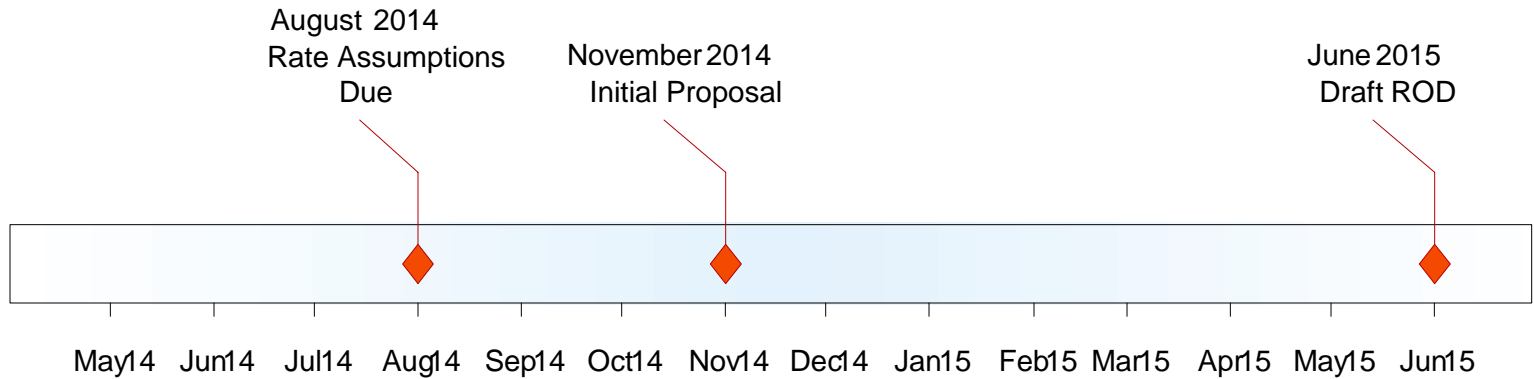
BP-16 Gen Inputs

- For the BP-16, BPA will keep all elements in the rate case process.

BP-12 Gen. Inputs and ACS Rate Setting Approach



Potential Timelines



Alt1: Rate Case



Nov14- Jun15
Formal 7(i)



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**BPA Staff Straw Proposal
Discussion**



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**Balancing Reserve Forecast
Performance Update**



Balancing Reserve Forecast Performance Update

- Balancing Reserve Forecast (BRF):
 - Real-Time Reserve Requirement Tool (R3T) is the internal option or “build” option
 - One vendor (WEPROG) is producing an external option or “buy” option.
 - Both Balancing Reserve Forecasts are produced every hour for 168 hours into the future.
- The purpose of this presentation is to present analytics on the R3T forecast performance
- This presentation is NOT meant to address:
 - Presence and Depth of Market
 - Resource Sufficiency
 - Viability of business case



R3T Update

- R3T was originally intended to forecast only INC reserves.
- R3T INC forecasts are the actual output from the R3T prototype (stored in PI)
- An estimate of DEC reserves was constructed which mimics the algorithm for INC reserves:
 - When time allows, we will have it incorporated into the running prototype and stored in PI.



R3T Update Assumptions

- Actual R3T performance analyzed for BP-14:
 - Time frame is 10/16/13 to 4/29/14.
 - R3T forecast was active and valid for the entire WECC preschedule timeframe since mid-October 2013.
 - Actual R3T performance uses the BPA Super Forecast, which meshes several vendor forecasts into a superior forecast.
- Backcast R3T performance analyzed for BP-12
 - Time frame is 10/1/11 to 10/1/13.
 - Backcast R3T performance uses a combination of the BPA Super Forecast (out 3 days) and the 7 day forecast from one vendor (less accurate than Super Forecast).



R3T Update Assumptions

- Assumptions:
 - R3T forecast snapshot from 7:00 AM on day of preschedule timeframe used in analysis
 - Typical forecast timeframe used is for 36-60 hours into the future:
 - Forecast for 18-42 hours out on the low end
 - Forecast for 114-138 hours out on the high end:
 - Due to weekends and WECC holidays



R3T Performance Update

- Assumptions:
 - Forecast performance analyzed in two manners:
 - Using R3T Hourly Forecast as the reserves held
 - Using the maximum of the R3T 24-hour Hourly Forecasts for that day as the reserves held
 - Forecast performance measure against what BPA actually held for reserves for that period of time.
 - Performance measures of Possible DSO 216 Events
 - Limitations and Curtailments Separate
 - Number of Events
 - Magnitude of Events (Average and Maximum)
 - Curtailments measured as Total Wind SCE above Allocation at onset of forecast DSO 216 event
 - Limitations measured as the peak Total Wind SCE above Allocation from onset of forecast DSO 216 event to top of hour.



BP-14 Actual R3T Performance Update

DSO 216 Performance for BP-14 (10/16/2013 to 4/29/2014)

	Scenario		Limitations	Curtailments
1	Actual Reserves Held (Average held = 952/-1092 MW)	Count	12	3
2		Average MW	310 MW	313 MW
3		Max MW	612 MW	326 MW
4	R3T Hourly Forecast (Average held = 690/-736 MW)	Count	33	18
5		Average MW	362 MW	282 MW
6		Max MW	756 MW	788 MW
7	R3T 24-Hr Max Forecast (Average held = 798/-845 MW)	Count	18	9
8		Average MW	425 MW	254 MW
9		Max MW	738 MW	591 MW

- These are for level 1 DSO 216 events (90% reserves deployed)
- NOTE: 99.5% coverage under the current BP-14 balancing reserves methodology does not have a direct translation into the coverage that could be given under the R3T forecast.



BP-12 Actual R3T Performance Update

DSO 216 Performance for BP-12 (10/1/2011 to 9/30/2013)

	Scenario		Limitations	Curtailments
1	Actual Reserves Held (Average held = 705/-907 MW)	Count	141	128
2		Average MW	326 MW	318 MW
3		Max MW	922 MW	810 MW
4	R3T Hourly Forecast (Average held = 675/-743 MW)	Count	108	80
5		Average MW	373 MW	341 MW
6		Max MW	918 MW	750 MW
7	R3T 24-Hr Max Forecast (Average held = 787/-855 MW)	Count	70	30
8		Average MW	392 MW	363 MW
9		Max MW	876 MW	713 MW

- These are for level 1 DSO 216 events (90% reserves deployed)
- NOTE: 99.5% coverage under the current BP-12 balancing reserves methodology does not have a direct translation into the coverage that could be given under the R3T forecast.



R3T Performance Update

- Assumptions:
 - Hypothetical reserve “buying” analyzed in two ways:
 - Use R3T forecast at face value
 - Assumes “buying” equal to 100% of the R3T forecast
 - ❖ Not feasible given current systems and markets
 - For both 24-hour max or hourly scenarios
 - Use R3T forecast to supplement actual reserves held
 - Assumes “buying” equal to R3T forecast amounts above actual reserves held (941 MW currently)
 - For both 24-hour max or hourly scenarios
 - “Buying” measures:
 - MW “bought” versus reserves held:
 - Average and Maximum for INC/DEC separately
 - Number of “purchase” periods



BP-14 INC Actual R3T Performance Update

“Buying” Measures (**INC Only**, Period Avg., 10/16/13 to 4/29/14)

	INC “Buying” Scenarios	Avg. Cap. “Bought”	Max Cap “Bought”	# of Periods
1	Actual Reserves Held	952 MW	970 MW	5112 hours 213 days
2	Reserves “bought” using R3T 24-Hr Max Forecast at Face Value*	798 MW	1309 MW	213 days
3	Reserves “bought” using R3T Hourly Forecast at Face Value*	690 MW	1309 MW	5112 hours
4	Reserves “bought” using R3T 24-Hr Max Forecast to Supplement Reserves Held	117 MW	368 MW	43 days
5	Reserves “bought” using R3T Hourly Forecast to Supplement Reserves Held	96 MW	368 MW	261 hours

* This is not feasible given current systems and markets



BP-12 INC Backcast R3T Performance Update

“Buying” Measures (**INC Only**, Period Avg., 10/1/11 to 10/1/13)

	INC “Buying” Scenarios	Avg. Cap. “Bought”	Max Cap “Bought”	# of Periods
1	Actual Reserves Held	705 MW	774 MW	17537 hours 731 days
2	Reserves “bought” using R3T 24-Hr Max Forecast at Face Value*	790 MW	1186 MW	731 days
3	Reserves “bought” using R3T Hourly Forecast at Face Value*	676 MW	1186 MW	17537 hours
4	Reserves “bought” using R3T 24-Hr Max Forecast to Supplement Reserves Held	117 MW	713 MW	473 days
5	Reserves “bought” using R3T Hourly Forecast to Supplement Reserves Held	53 MW	713 MW	6068 hours

* This is not feasible given current systems and markets



BP-14 DEC Actual R3T Performance Update

“Buying” Measures (**DEC Only**, Period Avg., 10/16/13 to 4/29/14)

	DEC “Buying” Scenarios	Avg. Cap. “Bought”	Max Cap “Bought”	# of Periods
1	Actual Reserves Held	-1092 MW	-1100 MW	5112 hours 213 days
2	Reserves “bought” using R3T 24-Hr Max Forecast at Face Value*	-835 MW	-1345 MW	213 days
3	Reserves “bought” using R3T Hourly Forecast at Face Value*	-726 MW	-1345 MW	5112 hours
4	Reserves “bought” using R3T 24-Hr Max Forecast to Supplement Reserves Held	-149 MW	-958 MW	21 days
5	Reserves “bought” using R3T Hourly Forecast to Supplement Reserves Held	-239 MW	-958 MW	135 hours

* This is not feasible given current systems and markets



BP-12 DEC Backcast R3T Performance Update

“Buying” Measures (**DEC Only**, Period Avg., 10/1/11 to 10/1/13)

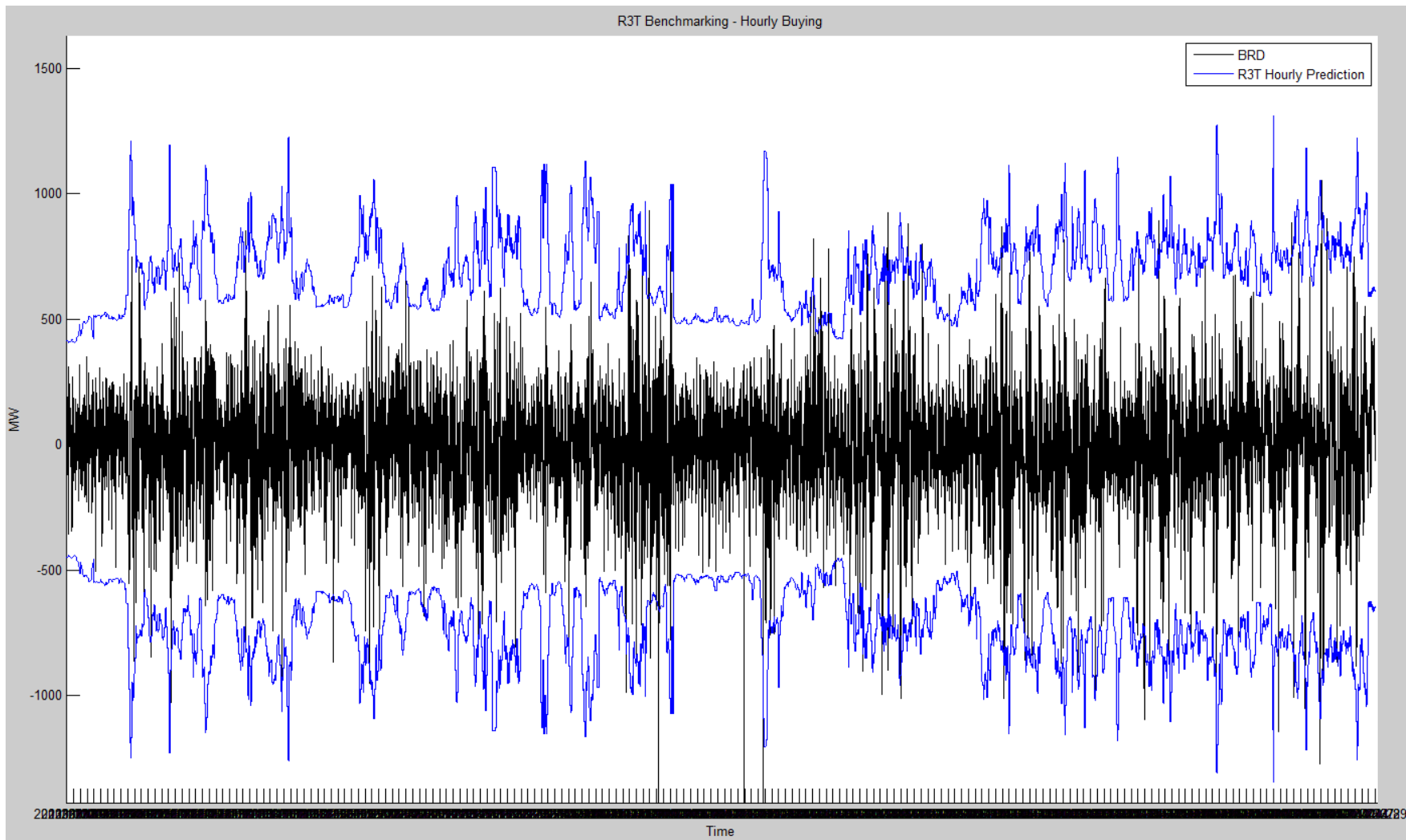
	DEC “Buying” Scenarios	Avg. Cap. “Bought”	Max Cap “Bought”	# of Periods
1	Actual Reserves Held	-907 MW	-992 MW	17537 hours 731 days
2	Reserves “bought” using R3T 24-Hr Max Forecast at Face Value*	-858 MW	-1251 MW	731 days
3	Reserves “bought” using R3T Hourly Forecast at Face Value*	-744 MW	-1251 MW	17537 hours
4	Reserves “bought” using R3T 24-Hr Max Forecast to Supplement Reserves Held	-57 MW	-820 MW	235 days
5	Reserves “bought” using R3T Hourly Forecast to Supplement Reserves Held	-29 MW	-820 MW	2406 hours

* This is not feasible given current systems and markets



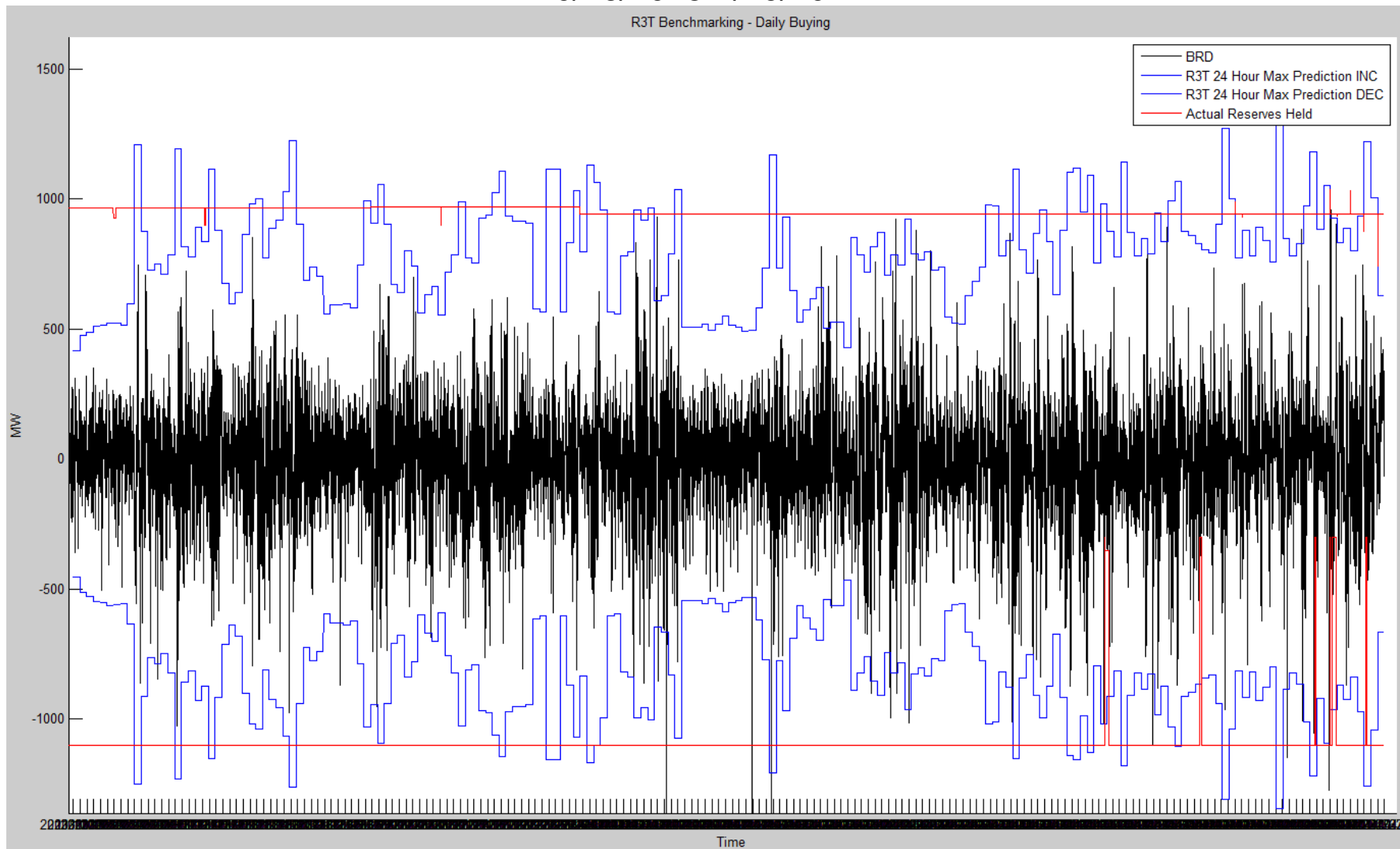
BP-14 Actual R3T Update - Hourly

10/16/2013-4/29/2014



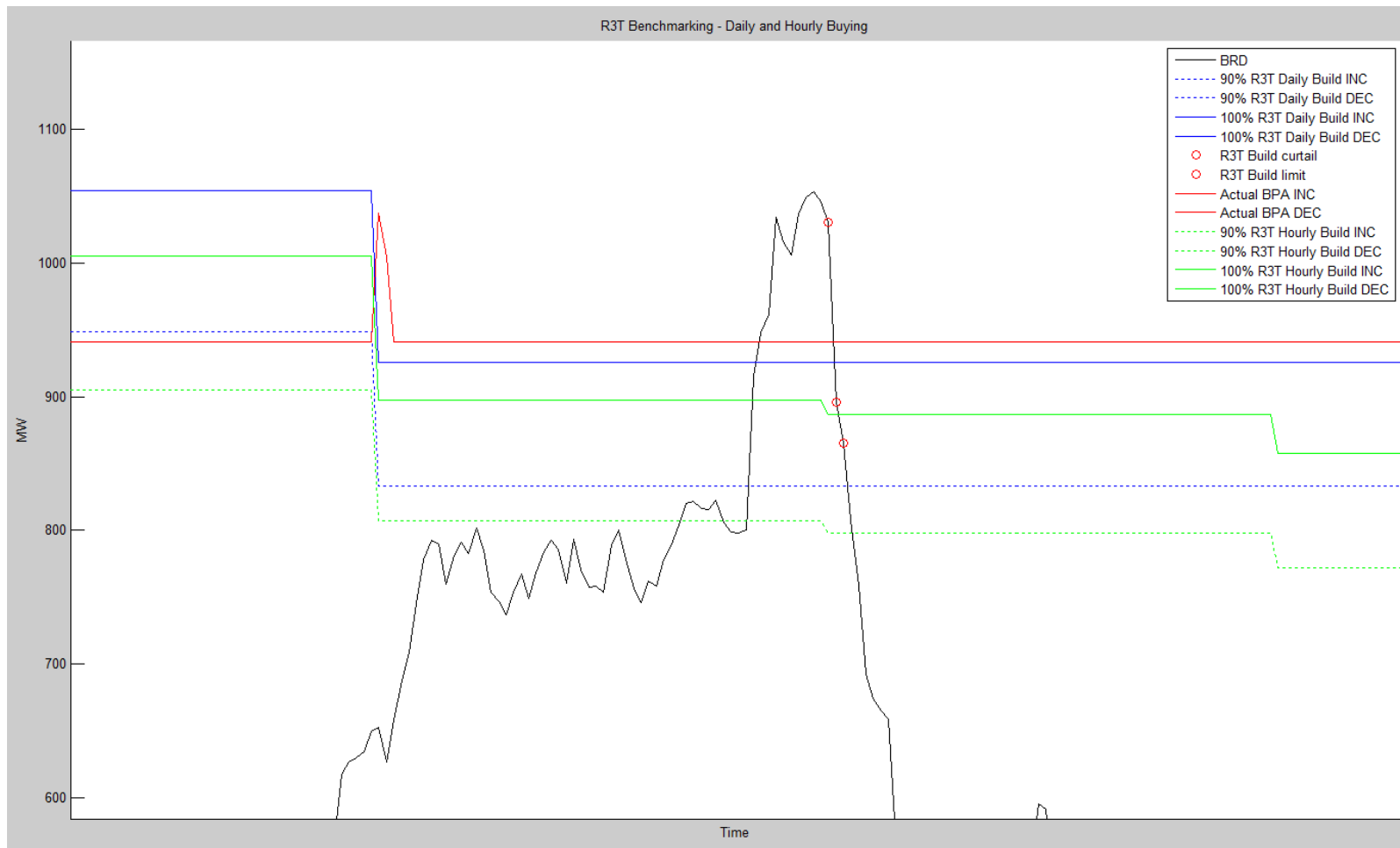
BP-14 Actual R3T Update - 24-hr Max

10/16/2013-4/29/2014



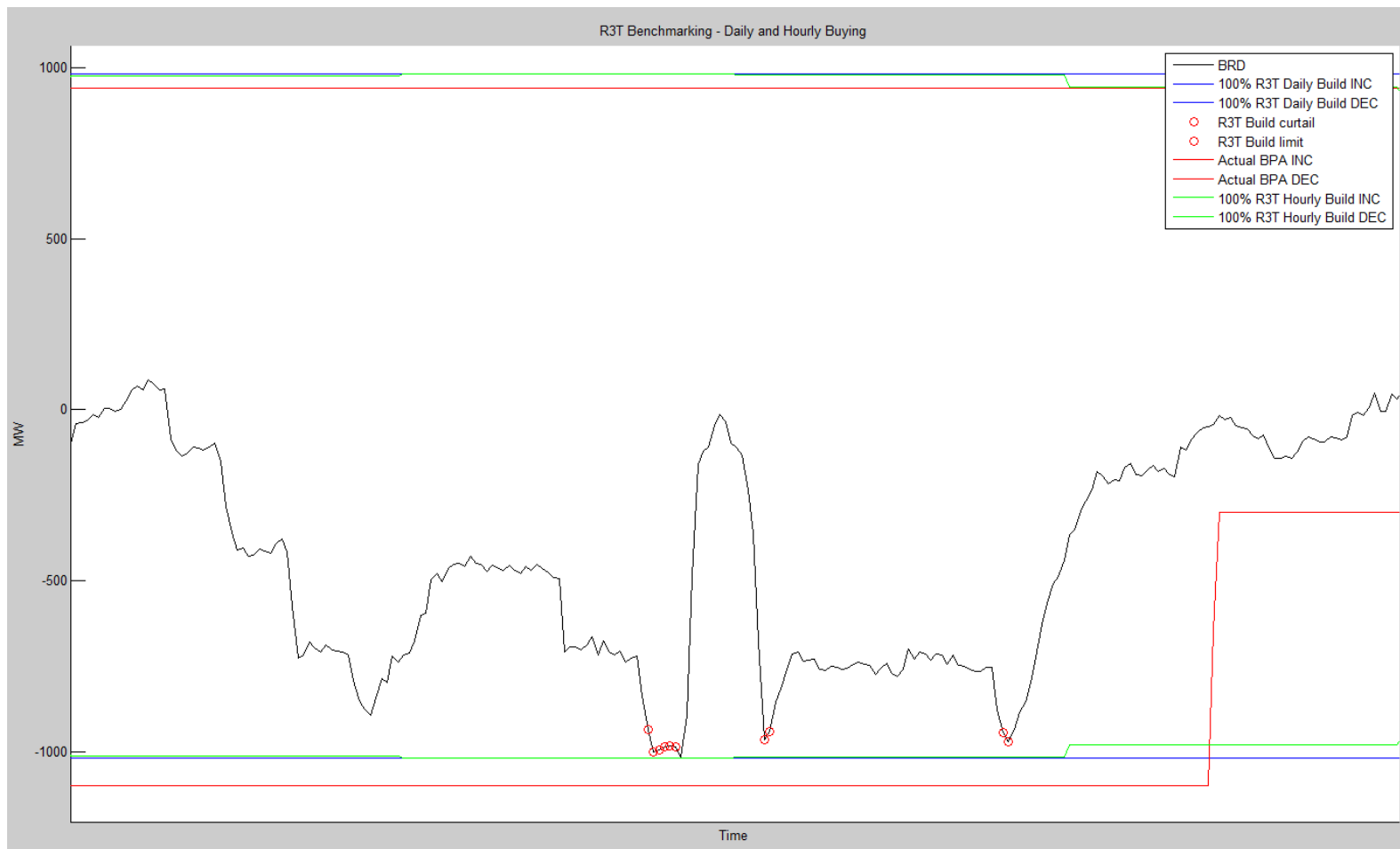
DSO 216 Close-Up

- 4/22/2014 Actual DSO 216 Curtailment
- R3T hourly, daily and actual reserves held failed.



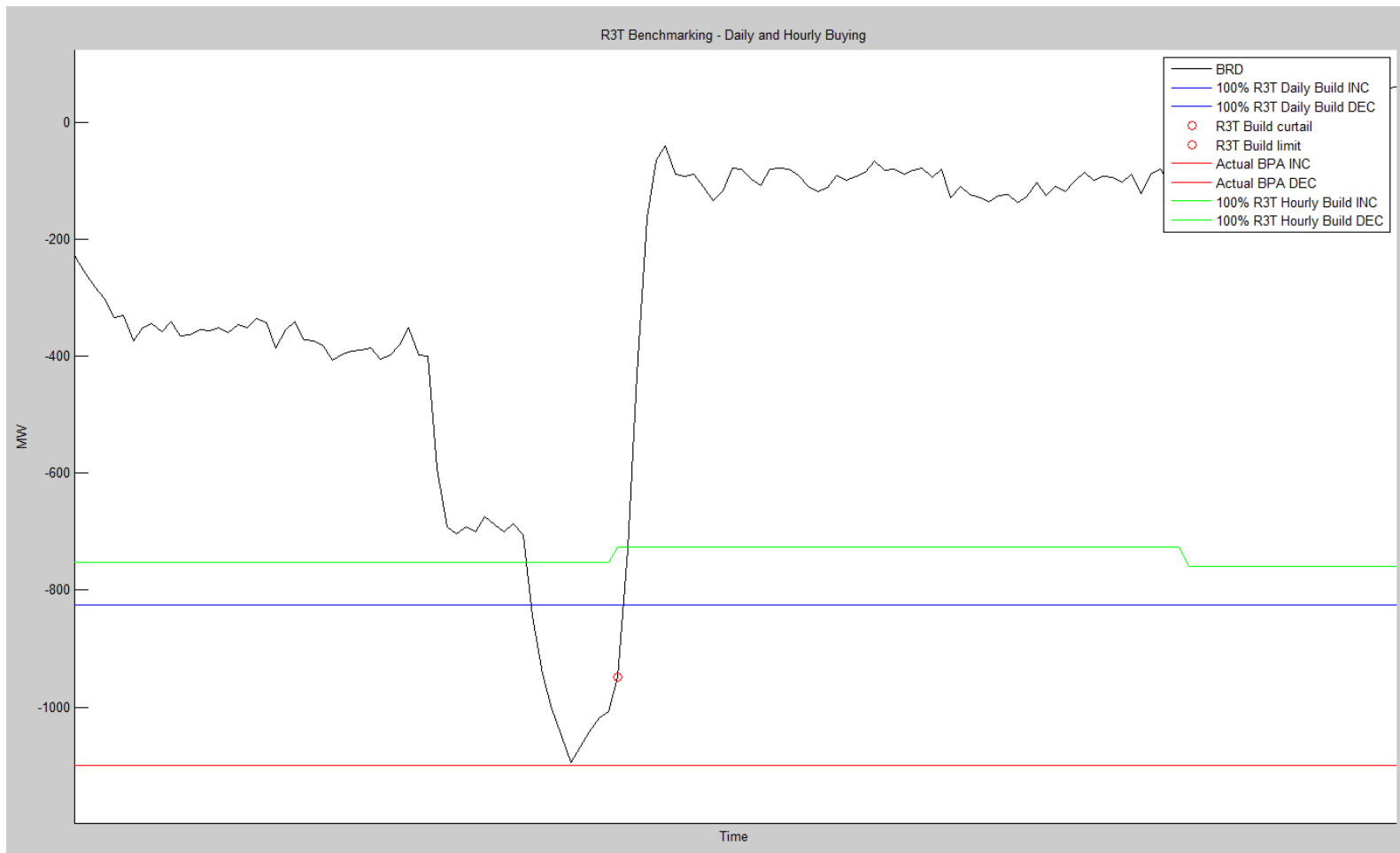
DSO 216 Close-Up

- 3/19/2014 HE 12 Actual DSO 216 Limitation
- R3T hourly, daily and actual reserves held failed.



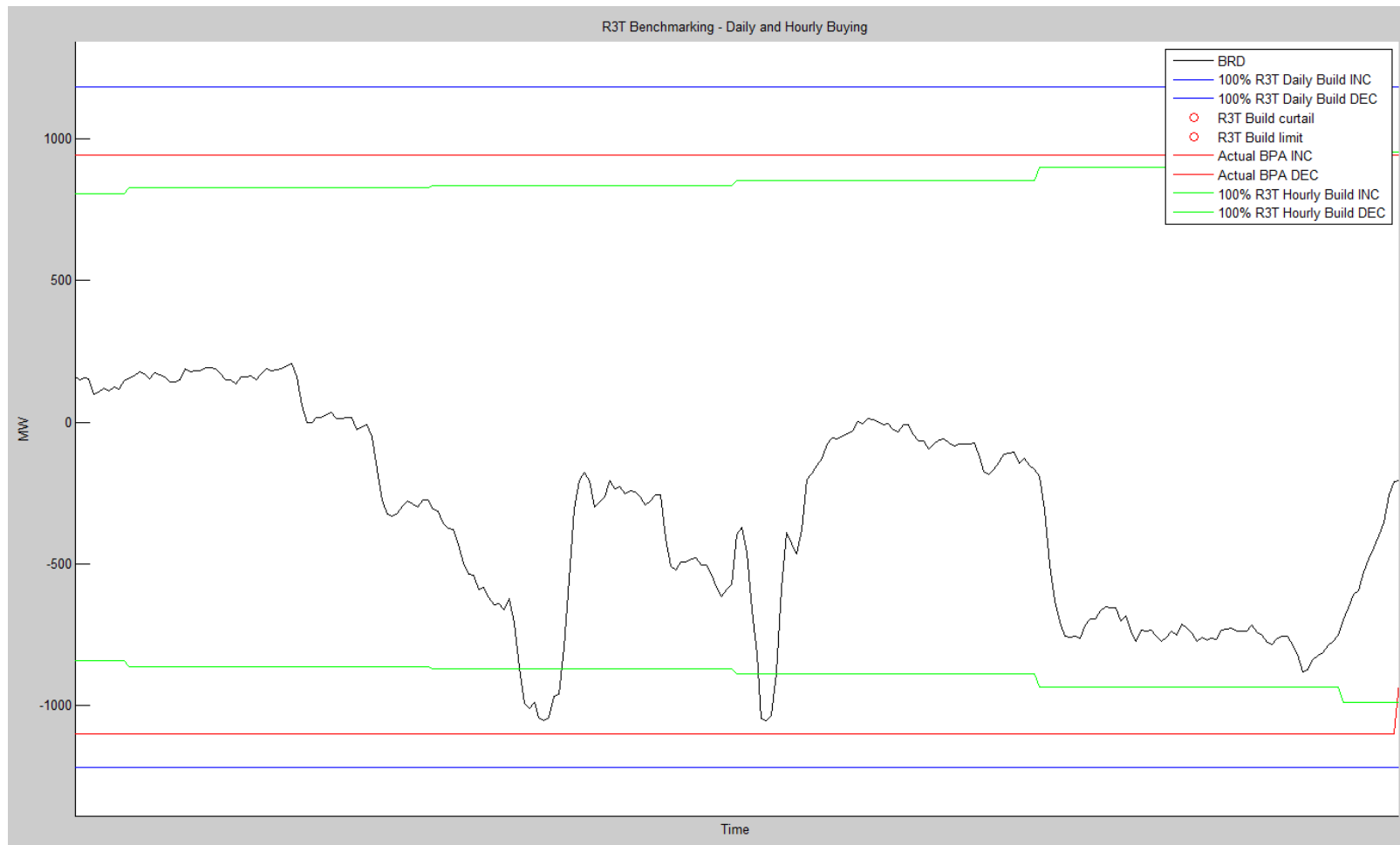
DSO 216 Close-Up

- 3/26/2014 HE 19 Actual DSO 216 Limitation
- R3T hourly, daily and actual reserves held failed.



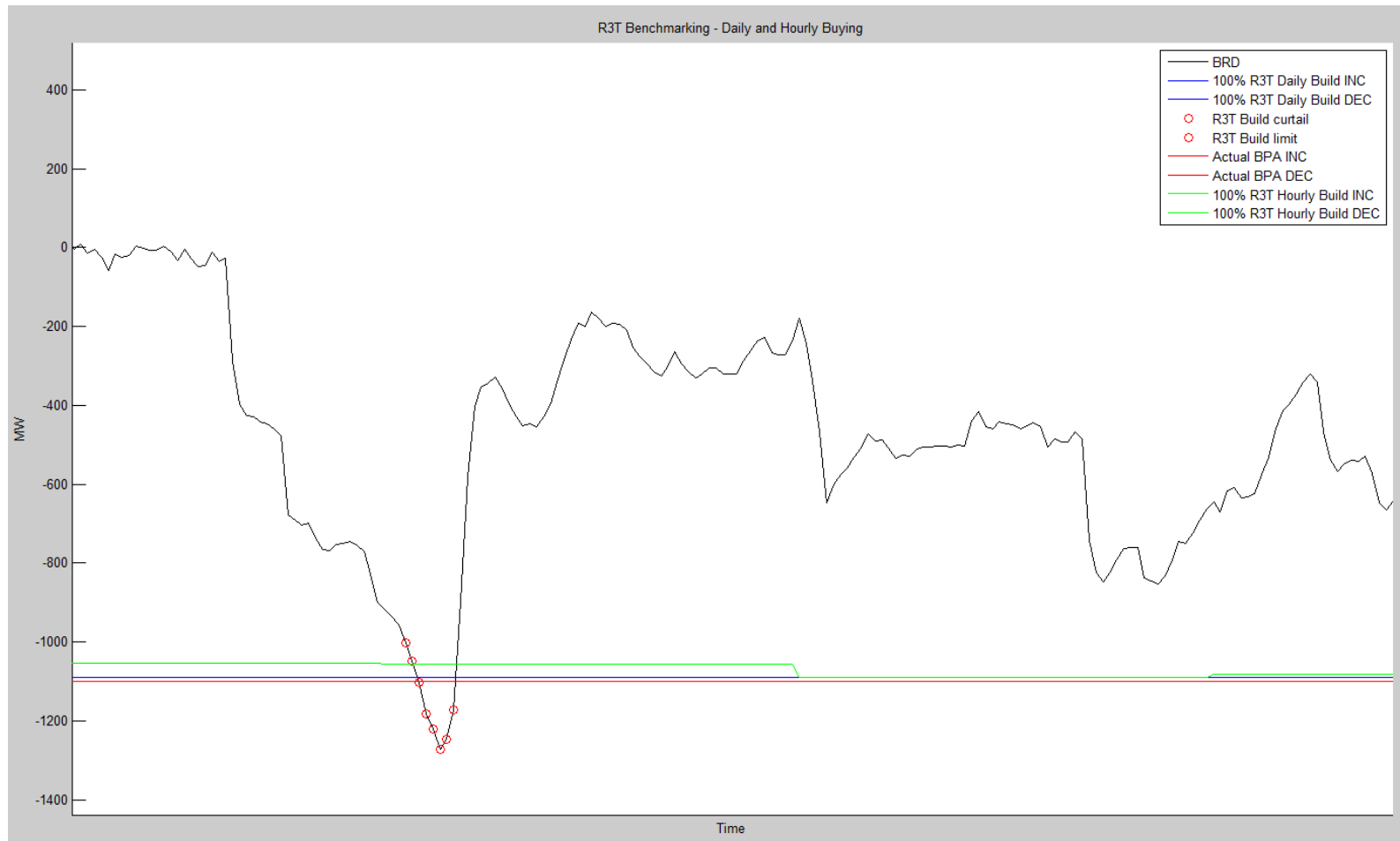
DSO 216 Close-Up

- 4/19/2014 HE14&15 Actual DSO 216 Limitation
- R3T hourly, daily and actual reserves held failed.



DSO 216 Close-Up

- 4/21/2014 HE 20 Actual DSO 216 Limitation
- R3T hourly, daily and actual reserves held failed.



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**Results of beta test and other
Pre-schedule Imbalance Capacity
Acquisitions**

Objectives for today's discussion

- Provide a high-level overview on the results of the pre-schedule reserve acquisition program to date for Operational Acquisitions (Type 2 reserves).
- Share any issues identified as part of the beta testing.
- Share high-level information on market liquidity to date for these acquisitions.



Background

- As part of the BP-14 Generation Inputs Rate Case Settlement, BPA committed to hold 900 MW Federal Columbia River Power System (FCRPS) INCing capacity.
- As part of our Rate Case obligation we agreed to acquire additional reserves known as Planned Acquisitions (Type1) on a quarterly basis to meet Base Service levels of reliability (99.5%).
- As part of the above effort, we also agreed to *attempt* to acquire from a third-party supplier any capacity shortfall caused by operational constraints which impact the FCRPS's ability to supply 900 MW of INCs. These reserves are called Operational Acquisitions (Type 2). Some of the reasons this could occur would be due to:
 - An oversupply situation
 - Physical loss of FCRPS units (including Columbia Generating Station)
 - A potential system loss or constraint which threatens BPA's ability to maintain the 99.5% reliability standard



Types of Within-hour Reserve Acquisitions for FY2014 - 2015

- **Planned Acquisitions* (Type 1)** – Monthly purchases required to cover the shortfall, if any, between the planned FCRPS balancing reserve capacity (900 MW INC, 1100 MW DEC) and the rate case planned balancing needs of base service (99.5% after adjusting for any self-supply of generation imbalance).
- **Operational Acquisitions* (Type 2)** – Purchases needed when BPA is either operationally unable or at risk of being unable to provide the planned FCRPS INC balancing reserve capacity necessary to meet the 99.5% reliability standard.
- **Full Service (Type 3)** – Purchases required to provide reserves for customer electing the VERB's Full Service balancing service plan. These will be made in smaller increments. Costs are charged to the full service customers.
- **Unplanned Service* (Type 4)** – Monthly purchases required to support an unplanned increase in balancing services required by the BPA Balancing Authority. These costs are directly assigned to the customers that create the unanticipated increase.
- **VERBS Supplemental Service (Type 5)** – Optional monthly service where BPA purchases reserves on behalf of customers requesting an amount they define. This service would be in addition to the base service. Customers may also acquire their own Supplemental Service with less notice for shorter periods. Costs are charged to SS customers.

*these acquisitions are for meeting or maintaining our base level service with the 99.5% reliability standard.



Results of the three beta test acquisitions

- Three Request for Offers (RFOs) were issued in early April:
 - The first RFO was 50 MWs for one day.
 - The second RFO was issued for 2 consecutive days.
 - The third RFO was issued for 100 MWs for one day.
- Two of the three RFOs resulted in successful acquisitions.
- Due to lack of demand, only one of the two successful acquisitions was deployed.
- On the third acquisition, two resources were successfully deployed.



Issues identified from beta testing

- There were some issues with management of the RFO distribution lists, which have since been corrected:
 - Namely, ensuring the RFO were sent directly to the real-time desks of all the counterparties.
- The beta testing was valuable in that it allowed us to fine tune the acquisition and implementation process before acquisitions became driven by system need.



Results of Actual Operational Acquisitions

- As of the date of this writing, BPA has issued 10 RFOs for Imbalance Capacity, counting the three Beta test RFOs.
- During this period, the targeted amount of Imbalance Capacity has ranged from 100 MW to 500 MW.
- Notwithstanding the beta test acquisition phase, each RFO issued has received bids. However, when seeking larger amounts of Imbalance Capacity, to date BPA has been unable to acquire sufficient capacity to mitigate reducing INC reserve levels on a number of occasions.
- Participation by counterparties has been disappointing to date, despite significant outreach efforts.
- At least one counterparty is still working through internal approvals to participate in the preschedule market.



General Observations

- Thus far we have experienced mixed market liquidity levels when attempting to purchase Imbalance Capacity in the preschedule time frame.
- To date, it appears that, generally speaking, thermal units have little interest in bidding on short-term capacity RFOs, at least during this time of year.
 - Specific feedback solicited from thermal advocacy groups has suggested that a minimum of at least one month would be required to solicit interest in participation.
- Many suppliers appear to have already made longer term capacity sales which effectively takes them out of the market for shorter term offers on most days.
- At least one Investor-Owned Utility (IOU) has stated that as a general rule, they never bid on capacity RFOs because company policy doesn't allow them to sell calls without special Executive approval.
- Both Northwest and Northern California system conditions have physically impacted a handful of counterparties' ability to participate in this year's RFO process in the spring.
- Feedback on BPA's acquisition process has generally been positive.



What's Next

- Continue outreach to potential suppliers to bring more parties to the table.
- Consider purchasing in HLH and LLH in an effort to increase participation.
- Spilt the RFOs into two separate requests when the preschedule buying period covers two days, especially when the buying need varies on each day.
- Other ideas?



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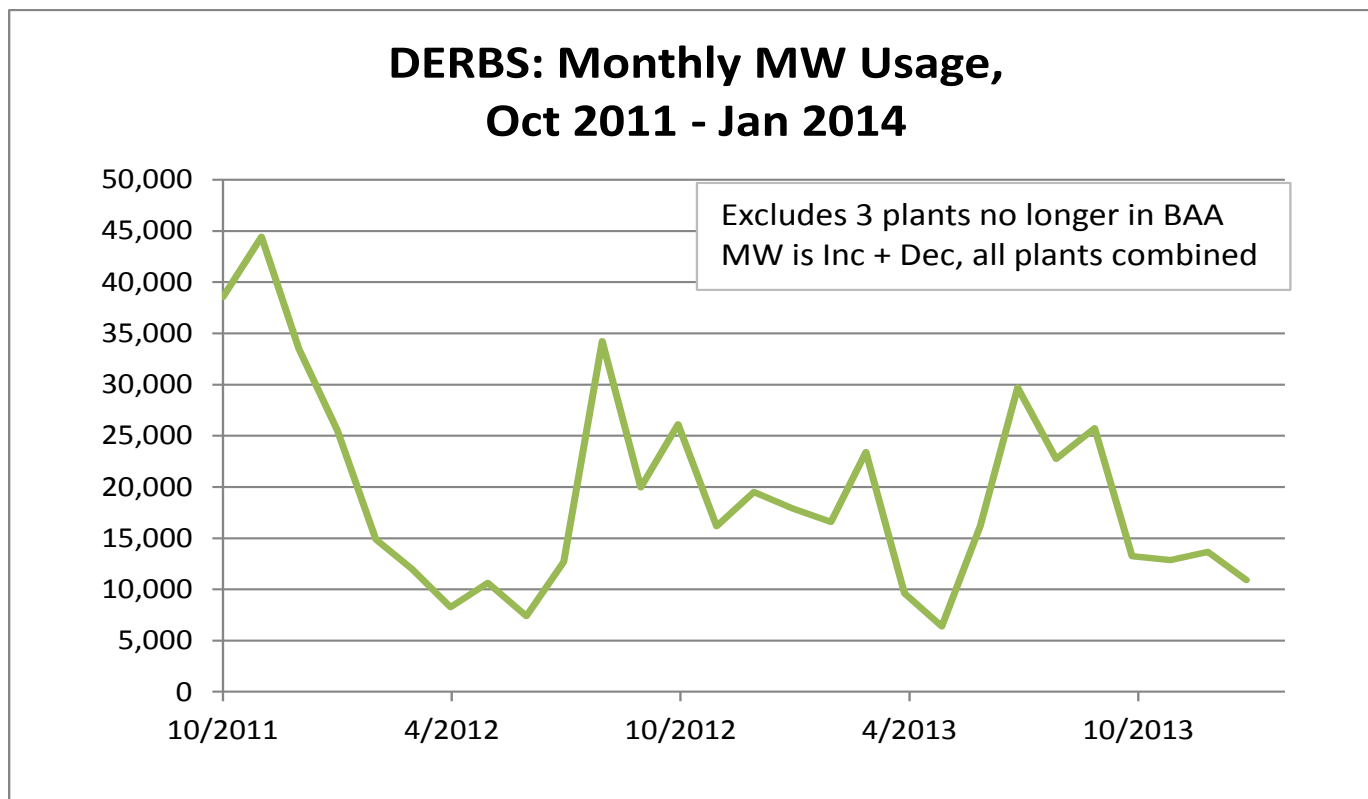
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DERBS: Experience So Far

DERBS: Monthly MW Usage

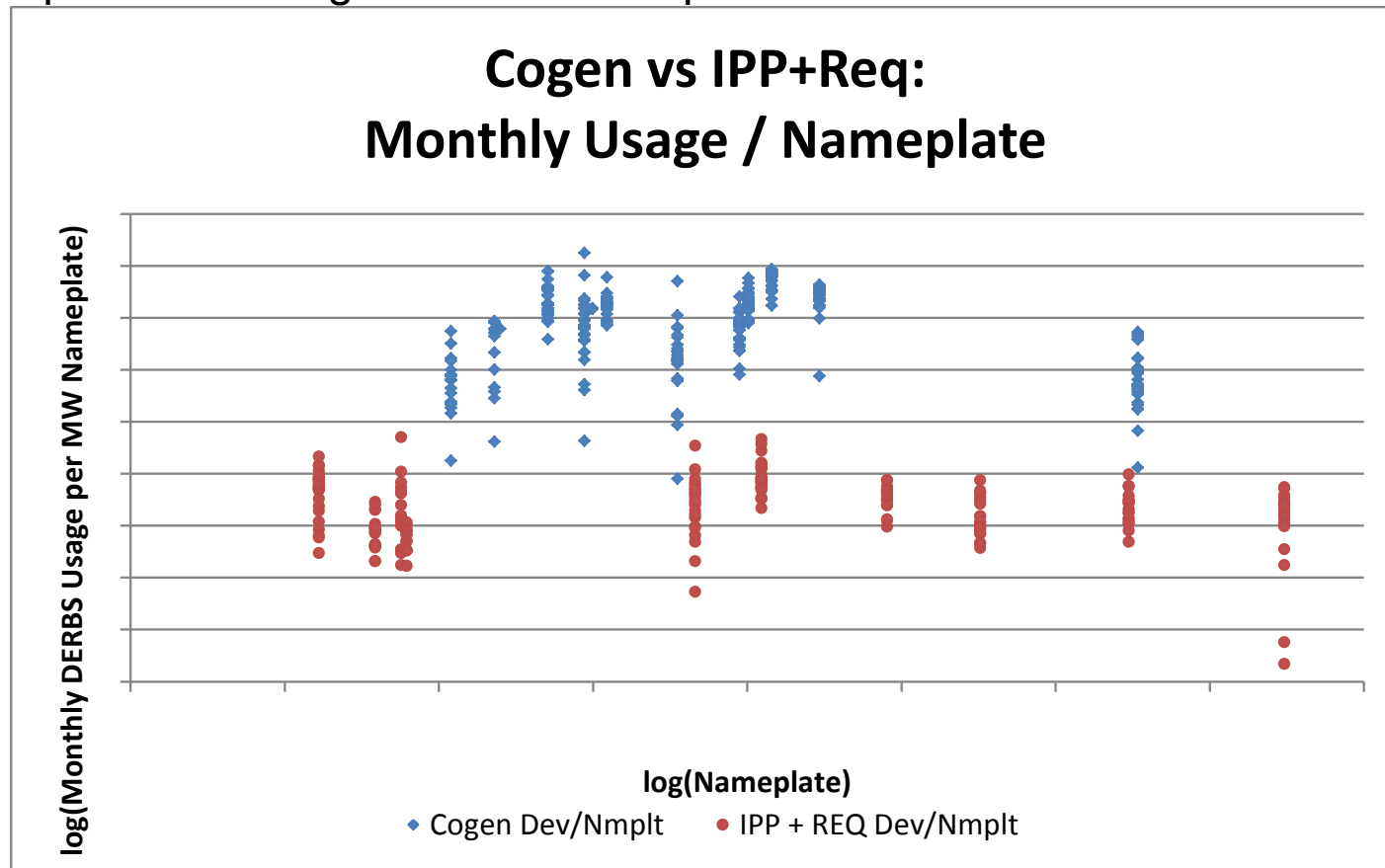
- Only includes Dispatchable Energy Resource Balancing Service (DERBS) plants now in Balancing Authority Area (BAA).
- Small changes coming:
Boardman out, Port Townsend & Nippon in
- Implication: Initial high usage gone. Now seasonally stable?



DERBS: Needs Differ by Type

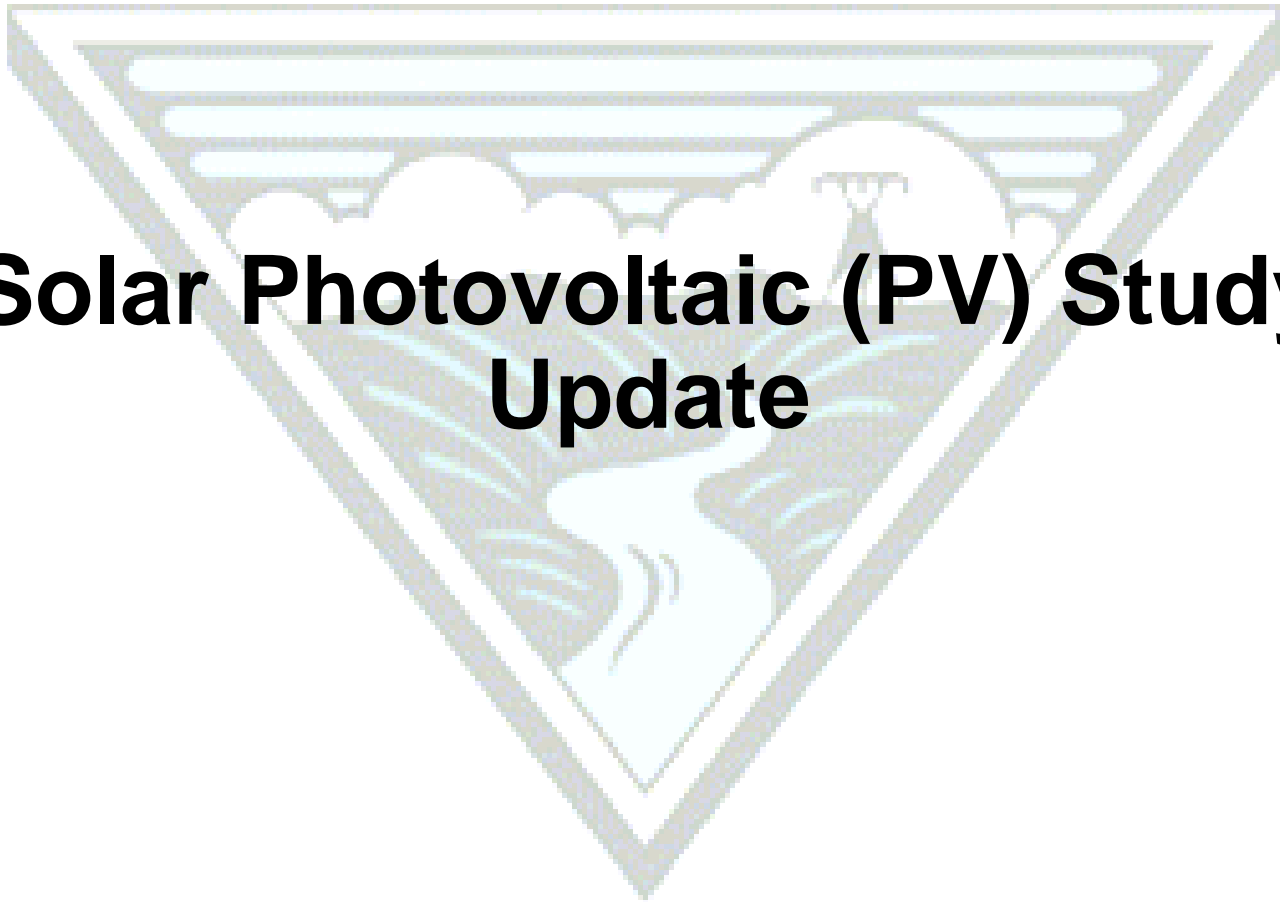
- Only includes DERBS plants now in BAA.
- Monthly Usage: *Inc + Dec*
- Implication: Usage-based rate important

Excludes 3 plants no longer in BAA.
Usage is Inc + Dec.
From Oct 2011 - Jan 2014.



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**Solar Photovoltaic (PV) Study
Update**



Solar PV Study Update

- Solar Generation Data:
 - BP-14 Dataset
 - BP-16 Dataset
 - Volatility Comparison for Different Datasets
 - Recommendation

- Solar Generation Schedules:
 - BP-14 Dataset
 - BP-16 Dataset
 - Recommendation
 - Volatility Comparison for Scheduling Options



Solar PV Study Update

- Solar Generation Data:
 - BP-14 Gen Data; Master Dataset from 10/1/07 to 9/30/11:
 - 4 years (10/1/2007 to 10/1/2011) of Solar PV Gen from Sacramento Municipal Utility District (SMUD) (1.655 MW)
 - No BPA data available
 - BP-16 Gen Data; Master Dataset from 10/1/09 to 9/30/13:
 - SMUD Data mostly unavailable after 10/1/2011 due to outages and equipment retirement
 - BPA Data available from 11/1/2012 to present for 5 MW Solar PV generation in BPA



Solar PV Study Update

- Solar Generation Data Volatility:
 - 1.655 MW Solar PV from SMUD (10/1/09 – 9/30/11)
 - 5 MW Solar PV from BPA (11/1/12 – 4/30/14)
 - Compares raw Regulation volatility:
 - Difference between 10 minute averages (w/o ramps) and actual generation signals
 - All generation scaled to the 5 MW size
 - No diversity with load or other generation assumed
 - Percentile is center of the bell curve
 - ❖ I.e., for 99.5%, INC is 99.75% percentile and DEC is 0.25% percentile



Solar PV Study Update

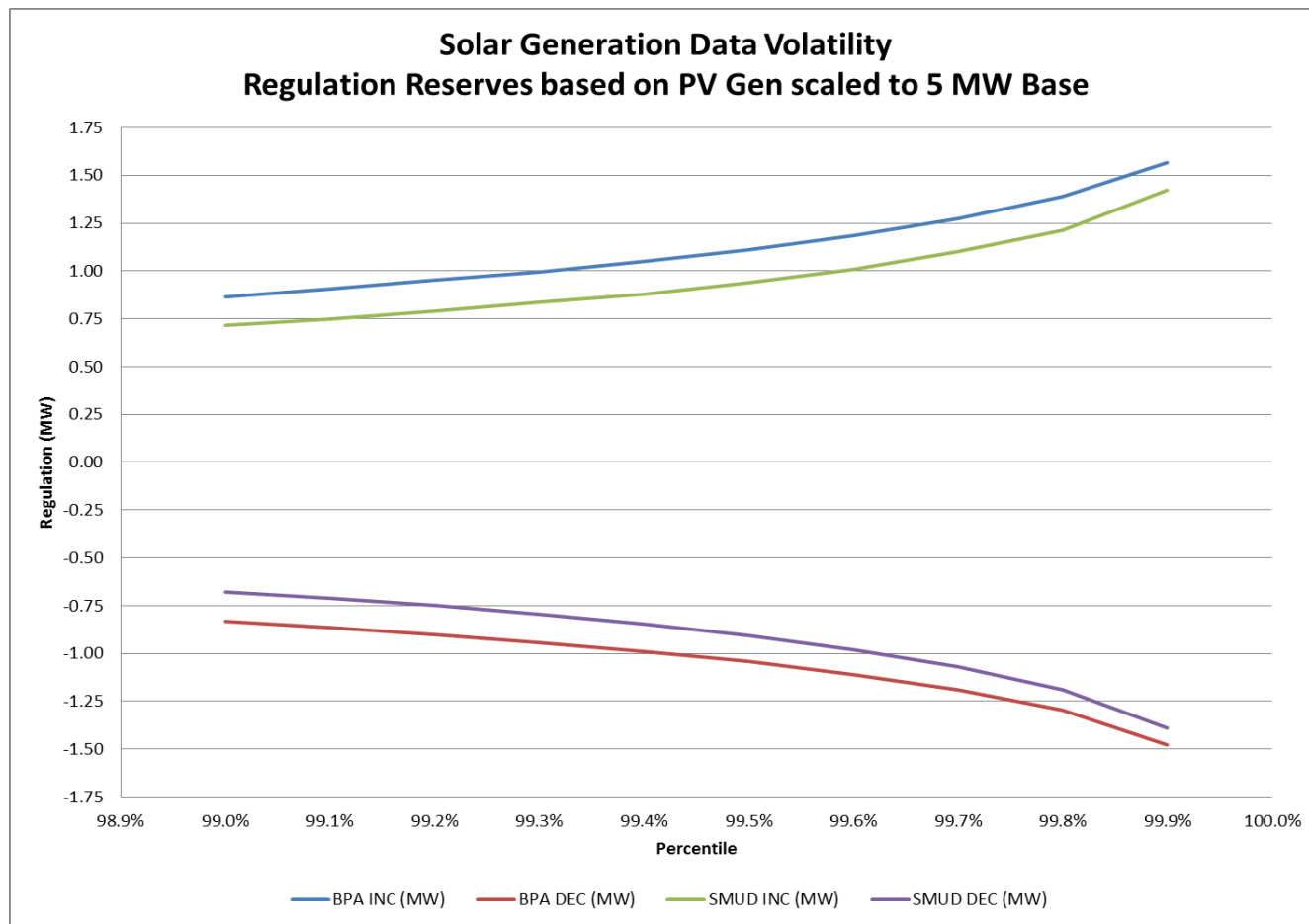
- Solar Generation Data Volatility
 - 10 minute Averages vs. Actual Gen

		BPA (5 MW Plant)		SMUD (1.655 MW Plant; Scaled to 5 MW)	
	Percentile	INC (MW)	DEC (MW)	INC (MW)	DEC (MW)
1	99.0%	0.87	-0.83	0.72	-0.68
2	99.1%	0.91	-0.86	0.75	-0.71
3	99.2%	0.95	-0.90	0.79	-0.75
4	99.3%	1.00	-0.94	0.84	-0.79
5	99.4%	1.05	-0.99	0.88	-0.84
6	99.5%	1.11	-1.04	0.94	-0.90
7	99.6%	1.18	-1.11	1.01	-0.98
8	99.7%	1.28	-1.19	1.10	-1.07
9	99.8%	1.39	-1.30	1.21	-1.19
10	99.9%	1.57	-1.48	1.42	-1.39



Solar PV Study Update

- Solar Generation Data Volatility
 - 10 minute Averages vs. Actual Gen



Solar PV Study Update

- Solar Generation Data:
 - Recommendation is to generate 4 years of Solar PV Data by using:
 - 2 years of 1.655 MW PV Gen from SMUD
 - Plus 1 month of shifted 5 MW PV Gen from BPA
 - Shift 10/1/13 to 10/31/13 to 2 years prior
 - Plus 11 months of shifted 5 MW PV Gen from BPA
 - Shift 11/1/12 to 10/31/13 to 1 year prior
 - Plus 11 months of 5 MW PV Gen from BPA (11/1/2012 to 9/30/2013)
 - Scale these to a uniform MW amount and merge into one 4-year dataset



Solar PV Study Update

- Solar Scheduling Data:
 - BP-14 Schedule Data (10/1/07 to 9/30/11):
 - No SMUD Schedule data
 - Created scheduling matrix assumption of average PV Generation binned by Hour of Day and Month.
 - BP-16 Schedule Data (10/1/09 to 9/30/13):
 - No SMUD Schedule data
 - BPA Data available from 11/1/2012 to present for 5 MW Solar PV Gen in BPA



Solar PV Study Update

- Solar Scheduling Data:
 - Recommendation is for elections and committed scheduling performance metrics, similar to Wind
 - Schedule Options include:
 - 30 Minute Persistence on 15 Minute Schedules (30/15)
 - 40 Minute Persistence on 15 Minute Schedules (40/15)
 - 30 Minute Persistence on 60 Minute Schedules (30/60)
 - Uncommitted Scheduling:
 - Assumes 45 Minute Persistence on 60 Minute Schedules (45/60)
 - Scheduling Matrix assumption from BP-14:
 - 12 month by 24 hour matrix of schedules (updated yearly)



Solar PV Study Update

- Solar Schedule Performance:
 - Ran on 5 MW Solar PV data from BPA (11/1/12 – 4/30/14)
 - Ran all proposed scheduling elections:
 - 30/15, 40/15, 30/60, Uncommitted (45/60) & Schedule Matrix
 - Compares raw Balancing Reserve consumption:
 - Difference between actual generation and schedules (with ramps)
 - No diversity with load or other generation assumed
 - Percentile is center of the bell curve:
 - ❖ I.e., for 99.5%, INC is 99.75% percentile and DEC is 0.25% percentile



Solar PV Study Update

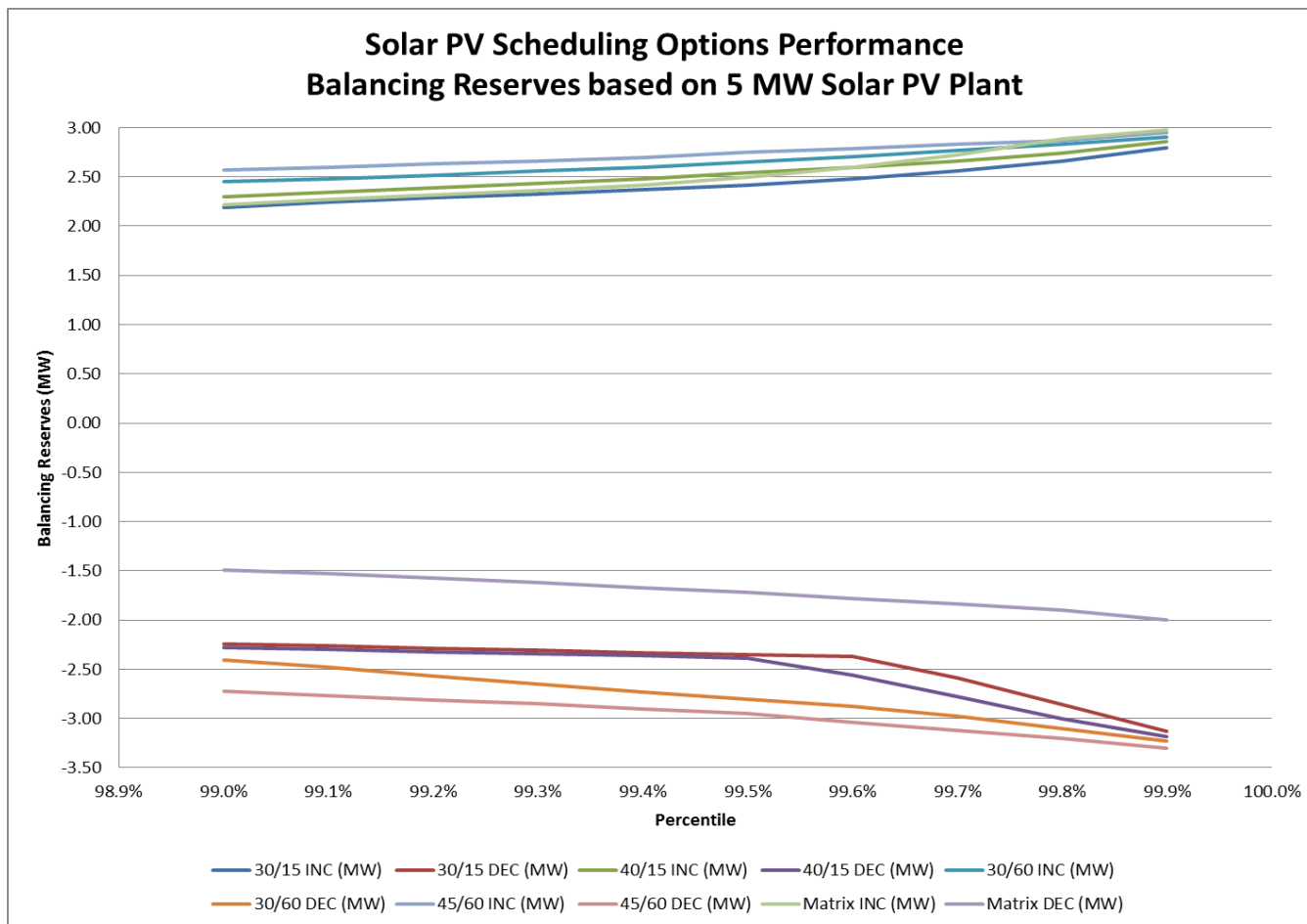
- Solar Schedule Performance
 - Schedules vs. Actual Gen

		30/15 Schedules		40/15 Schedules		30/60 Schedules		45/60 Schedules		Schedules Matrix	
	Percentile	INC (MW)	DEC (MW)	INC (MW)	DEC (MW)	INC (MW)	DEC (MW)	INC (MW)	DEC (MW)	INC (MW)	DEC (MW)
1	99.0%	2.19	-2.24	2.30	-2.28	2.45	-2.41	2.57	-2.72	2.22	-1.49
2	99.1%	2.24	-2.26	2.34	-2.30	2.48	-2.48	2.60	-2.77	2.27	-1.53
3	99.2%	2.29	-2.29	2.39	-2.32	2.52	-2.57	2.63	-2.81	2.32	-1.57
4	99.3%	2.33	-2.31	2.43	-2.34	2.56	-2.65	2.66	-2.85	2.36	-1.62
5	99.4%	2.37	-2.33	2.48	-2.36	2.60	-2.73	2.70	-2.90	2.42	-1.67
6	99.5%	2.42	-2.35	2.54	-2.39	2.65	-2.80	2.75	-2.95	2.50	-1.72
7	99.6%	2.48	-2.37	2.60	-2.56	2.71	-2.88	2.79	-3.04	2.60	-1.78
8	99.7%	2.56	-2.59	2.66	-2.78	2.77	-2.98	2.83	-3.12	2.72	-1.84
9	99.8%	2.66	-2.86	2.74	-3.00	2.83	-3.10	2.87	-3.20	2.89	-1.90
10	99.9%	2.80	-3.13	2.86	-3.18	2.90	-3.23	2.95	-3.30	2.98	-2.00



Solar PV Study Update

- Solar Schedule Performance
 - Schedules vs. Actual Gen



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Customer Presentations